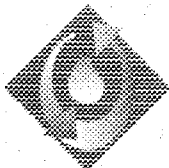
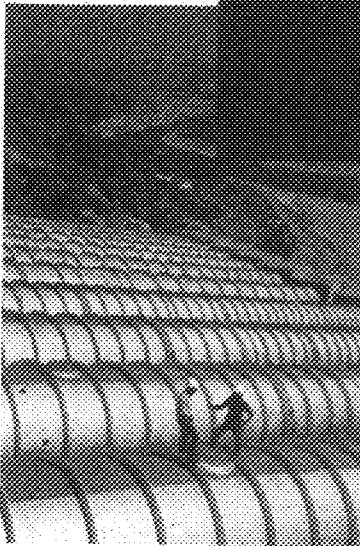
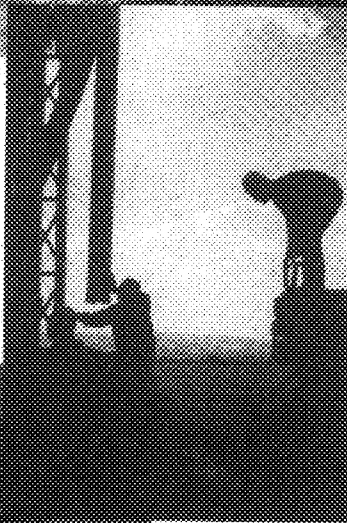
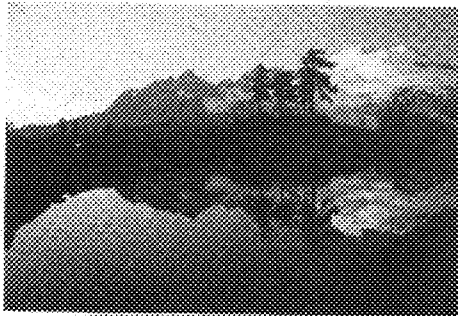


**Seventh Annual  
Meeting  
1998**

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Groundwater  
Resources  
Association  
Presents

# California Groundwater Effective and Efficient Usage for the Year 2000 and Beyond



GROUNDWATER RESOURCES ASSOCIATION

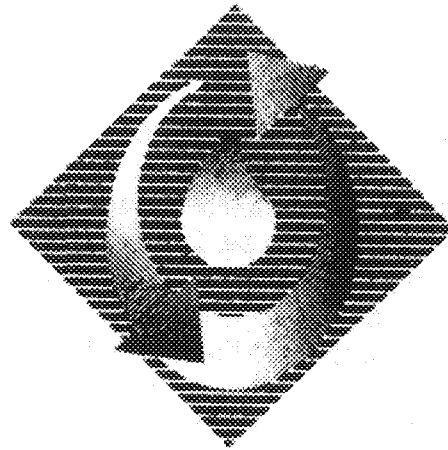
**WALNUT CREEK MARRIOTT**

2355 NORTH MAIN STREET  
WALNUT CREEK, CALIFORNIA

**OCTOBER 22 AND 23, 1998**

Seventh Annual Meeting – 1998

**CALIFORNIA GROUNDWATER  
EFFECTIVE AND EFFICIENT USAGE  
FOR THE YEAR 2000 AND BEYOND**



**GROUNDWATER RESOURCES ASSOCIATION  
OF CALIFORNIA**

**IN COOPERATION WITH:**  
Bay-Delta Modeling Forum  
California Department of Water Resources  
Cal/EPA - Department of Toxic Substances Control  
NGWA, Association of Ground Water Scientists & Engineers  
State Water Resources Control Board  
Water Education Foundation

## **DAY 2: Friday, October 23, 1998**

### **ENVIRONMENTAL SESSIONS**

#### **SESSION 1: PERCHLORATE ISSUES EXAMINED**

- 8:15 – 8:45 am     **Lt. Colonel Dan Rogers**, United States Air Force  
*Overview and History of Perchlorate Problem*
- 8:45 – 9:15 am     **Kevin Mayer**, United States Environmental Protection Agency (USEPA)  
*Perchlorate Occurences in the United States*
- 9:15 – 9:45 am     **Steve Book**, California Department of Health Services  
*Implications of Low Concentrations of Perchlorate in Drinking Water and the State of California's Advisory Level*
- 9:45 – 10:15 am     **James Clark, Komex – H2O Science**  
*Health Effects of Perchlorate and the New Reference Dose*
- 10:15 - 10:30 am     **BREAK**
- 10:30 - 11:00 am     **Tom Browne, Komex - H2O Science**  
*Treatment Options for Perchlorate - What is Working?*
- 11:00 – 11:30 am     **Carol Williams, Main San Gabriel Basin Watermaster**  
*Perchlorate in the San Gabriel Valley - The Effects of the New Advisory Level*
- 11:30 – 12:00 pm     **Greg Patterson, McClintok Weston Benshoof**  
*Legal Perspective on Perchlorate*
- 12:00 – 1:30 pm     **LUNCH**  
**GRA ANNUAL MEETING AND MEMBER RECOGNITION**  
**Brian Lewis, GRA Statewide President**

#### **SESSION 2: EFFECTIVE APPROACHES FOR BROWNFIELD TRANSACTIONS**

- 1:30 – 2:00 pm     **Edith Pepper**, California Center for Land Recycling  
*Strategies for Promoting Brownfield Reuse in California*
- 2:00 – 2:45 pm     **Ignacio Dayrit**, City of Emeryville  
*Successful Strategies for Converting Properties in Emeryville*
- 2:45 – 3:15 pm     **Jeffery V. Dagdigian**, Waterstone Environmental, LLC  
*Consultant's Role, Managing Investor Risk in Developments*
- 3:15 - 4:00 pm     **Jon K. Wactor**, Luce, Forward, Hamilton & Scripps LLP  
*Legal and Insurance Strategies, Brownfield Redevelopment*
- 4:00 pm             **Annual Meeting Adjourned**

## **SATURDAY, OCTOBER 24, 1998, FIELD TRIP**

**GEOLOGY AND HYDROGEOLOGY OF SAN FRANCISCO BAY AREA**, Sponsored by GRA San Francisco Branch, American Institute of Professional Geologists California Section and Association of Engineering Geologists San Francisco Chapter

**Logistics:** Depart: 7:30 am, Walnut Creek Marriott, Return: 5:30 pm; Field Trip Fee Includes Transportation, Boxed Lunches and Field Trip Guidebook.

**Field trip Itinerary:** Tour San Francisco Bay area showing regional geology and hydrologic features. Tour stops include: Lawrence Hall of Science in Berkeley; East Bay area; Treasure Island overview on how island was created and why it is difficult to remediate; Presidio of San Francisco hydrogeology overview and Lunch stop; Crissy Field marsh restoration project; Golden Gate National Recreation Area Franciscan Melange Sequence; and Corps of Engineers Sausalito Bay Model.

**Information:** Jim Jacobs, FAST-TEK, 510/232-2728, ext. 222 or email: [augerpro@ips.net](mailto:augerpro@ips.net)

**Day 2: Friday, October 23, 1998**

**Environmental Sessions**

**OCCURRENCE OF PERCHLORATE IN GROUNDWATER AND SURFACE WATER  
SUPPLIES IN THE UNITED STATES**

Mayer, K.P., U.S. EPA Region 9, 75 Hawthorne St., Mail Code SFD-7-2, San Francisco, CA  
94105-3901. Mayer.kevin@epamail.epa.gov

At least fourteen separate sources of perchlorate contamination of groundwater were discovered in California within a few months of developing an improved analytical method. Detectable levels of the contaminant have been measured in more than 110 public water supply wells in California. Shortly after the groundwater contamination was recognized, low levels of perchlorate were found in the Colorado River downstream of perchlorate manufacturing facilities in Nevada. More than 15 million people in California, Nevada, Arizona and Native American Tribes rely on this irreplaceable source of water. As the analytical method became known outside California, perchlorate was confirmed in water in Utah, Texas, Arkansas, Maryland and New York and investigations are under way in several other states. Perchlorate has been manufactured or shipped to solid rocket fuel and explosives facilities in nearly every state in the U.S. The potential threat to water resources warrants a concerted, systematic effort to identify and examine possible sources of perchlorate contamination throughout the country.

**Kevin Mayer** has managed large groundwater contamination cleanup projects since joining EPA as Superfund Project Manager in 1990. He currently heads the Perchlorate Team in Region 9 which brings together water and waste experts, toxicologists, engineers and scientists from several divisions in the regional office. Region 9 covers Nevada, Arizona, California and Hawaii with the Regional office in San Francisco.

Kevin holds graduate degrees in soil science/microbiology (University of Washington) and Civil Engineering (Stanford University) focusing on fate and transport of chemical contamination in soil and groundwater. Prior to employment with EPA, Kevin worked in the Water Quality Planning division of the Municipality of Metropolitan Seattle, and as a hazardous waste management and groundwater cleanup expert for a Silicon Valley electronics firm in California.

## **PERCHLORATE IN DRINKING WATER: IMPLICATIONS OF LOW CONCENTRATIONS AND CALIFORNIA'S ACTION LEVEL**

Steven Book, Drinking Water Program, California Department of Health Services,  
Sacramento, CA

As a result of 1997 findings of perchlorate in drinking water wells in California, the Department of Health Services (DHS) established an advisory "action level." DHS' action level for perchlorate was needed because it was not considered a common contaminant, and there were no federal or state drinking water standards. In establishing its action level, DHS used U.S. EPA 1992 and 1995 health evaluations, which identified sensitive thyroid-gland related effects as critical endpoints (*i.e.*, the release of iodine from the thyroid and inhibition of iodine uptake by the thyroid). From the EPA reports, DHS determined that a drinking water concentration of 4 to 18 ppb was protective of public health, and established its action level at 18 ppb.

At the same time, DHS Sanitation and Radiation Laboratory developed an improved analytical method for perchlorate that reduced the level of detection to 4 ppb, and developed a process by which commercial laboratories could be "approved" for the DHS method for perchlorate analyses. In 1997 DHS sampled perchlorate in wells in selected locations. Sampling included more than 500 drinking water wells, and over 100 had detectable levels of perchlorate. Affected wells were primarily in eastern Sacramento County, and in southern California, in San Bernardino, Riverside, and Los Angeles Counties. Several dozen public water supply wells contained perchlorate at levels greater than the 18-ppb action level, with a few reaching the 300-ppb range.

DHS action levels are advisory, although when a well exceeds an action level, the public water system is required (*Health & Safety Code §116455*) to notify the governing body of the local agency in which users of the drinking water reside (*e.g.*, the city council and/or county board of supervisors). In addition, when action levels are exceeded, DHS advises the water system to remove the contaminated source from service. If the source is required to meet system demands and cannot be removed from service, DHS advises the utility to arrange for public notification to its customers, including renters, workers and students. Recent legislation was proposed to require DHS to develop a drinking water standard for perchlorate. Although this was vetoed, the Governor directed DHS to adopt a standard as soon as possible after U.S. EPA completes its review of perchlorate toxicity and updates its reference dose.

**Steve Book** is a toxicologist with the California Department of Health Services' (DHS') drinking water program. Dr. Book has held a number of positions in California's public health and environmental protection agencies: DHS, the Health and Welfare Agency, and Cal/EPA's Office of Environmental Health Hazard Assessment. Most of his work involves the evaluation of public health risks from environmental contaminants, and the incorporation of scientific matters into public policy. Prior to joining state service, he was on the research faculty of the University of California at Davis. He has also worked as an environmental consultant.

## **HEALTH EFFECTS OF PERCHLORATE AND THE NEW REFERENCE DOSE (RfD)**

James J. J. Clark  
Komex•H2O Science

The toxicological impacts of low levels of perchlorate in drinking water supplies are ill defined. Perchlorate has been shown to inhibit iodine release from the thyroid with doses slightly greater than 0.14 mg/kg/day (Stansbury and Wyngaarden, 1952) in patients with Graves Disease. The mode of action for this inhibition of iodine release is believed to competitive competition with iodine for T3 and T4 receptors in the thyroid. Other toxicological effects, at high doses, may include gastrointestinal irritation, skin rash, nausea, and agranulocytosis. While short-term exposures to perchlorate result in suppressed iodine uptake, there is no evidence to suggest that chronic exposure to perchlorate may result in continued suppression of iodine metabolism.

Based on the uncertainties in the 1992 and 1995 provisional reference dose (RfD), the California Department of Health Services (DHS) recently promulgated an action level for perchlorate in water of 18 ppb. This provisional action level served as a catalyst to renew research on the potential toxicity of perchlorate during various crucial developmental stages (e.g., fetal development and adult reproductive development).

New studies were begun in 1997 to reduce uncertainty in the new reference dose (RfD) for perchlorate to be promulgated by the USEPA. The National Center for Environmental Assessment (NCEA) in the Office of Research and Development (ORD) have received data from studies performed in 1997/ 1998 which will be subjected to an external peer review in November 1998 before a final assessment is made. The new RfD is likely to consider the results of studies, which were designed to determine the target organ(s) other than the thyroid; receptor kinetics; developmental effects; absorption, distribution, metabolism, and elimination; mutagenicity/carcinogenicity; reproductive effects; and immunotoxicity of perchlorate.

**James J. J. Clark, Ph.D.** Dr. Clark is the senior risk analyst at Komex (Huntington Beach, CA) and lead scientist for Komex's MtBE and perchlorate research programs. James received his Ph.D. and M.S. in Environmental Health Sciences from the University of California at Los Angeles and his B.S. in Biochemical and Biophysical Sciences from the University of Houston. For the past ten years has been researching the effects of environmental contaminants on human and animal health. His work has included environmental fate and transport modeling, human health risk assessments, brownfield redevelopment, toxic-tort litigation research and support, and toxicological and medical literature research. His research expertise includes the toxicology of oxidant chemicals, volatile organic chemicals, semi-volatile organic chemicals, and metals.

## **TREATMENT OPTIONS FOR PERCHLORATE IN DRINKING WATER**

**Tom Browne and James J. J. Clark**  
Komex•H2O Science

Perchlorate ( $\text{ClO}_4^-$ ) is a group of anions that forms salts with most cations. The most common forms of perchlorate include ammonium perchlorate (used as a solid rocket propellant and ignitable source in munitions and fireworks) and potassium perchlorate (used to treat Graves Disease [hypothyroidism] since the 1950s). Perchlorate salts dissociate completely in water and aqueous tissues, therefore exposure is to the ion, not to the salt.

Perchlorate has been detected in shallow groundwater and drinking water supplies near former rocket manufacturing or testing facilities (as high as 3,700,000 ppb). Eighteen drinking water wells (6 in northern California and 12 in southern California) with perchlorate concentrations exceeding the DHS action level. Perchlorate has been detected (March 1997) in the Colorado River south of Lake Mead and in groundwater fields in northern California (Sacramento and Santa Clara), central California (Hollister), southern California (Los Angeles and Riverside Counties), and southern Nevada (Las Vegas).

Current treatment options for perchlorate include reverse osmosis, ion exchange, thermal oxidation, and biological reactors. Reverse osmosis and ion exchange work well, in bench scale tests, but are extremely expensive. Thermal oxidation is untested and unlikely to be of significant value to water purveyors, who will have to treat large volumes of water in a rapid and cost effective manner. Biological treatment systems may offer the most effective method for treating large quantities of perchlorate contaminated water and these systems are currently being evaluated in Florida and California.

**Thomas E. Browne, Ph.D., P.E.** Dr. Browne received his Bachelor of Science degree in Chemical Engineering from San Jose State University and his Ph.D. degree in Chemical Engineering from UCLA. He is a registered chemical engineer in the State of California and is a Certified Permitting Professional with the South Coast Air Quality Management District. As a senior engineer at Komex his responsibilities include the design, permitting, installation, and operation of soil and groundwater remediation systems.

Dr. Browne is presently on the Technical Advisory Committee of the MtBE Research Partnership, a consortium of members from the Association of California Water Agencies, the Western States Petroleum Association, and private consultancies. The committee has reviewed promising technologies for the removal of MTBE from potable water supplies and is preparing to publish its final report, which includes evaluations of activated carbon, air stripping, and advanced oxidation processes. The committee plans to carry out pilot scale demonstrations of all three technologies this year.

**PERCHLORATE IN THE SAN GABRIEL VALLEY - THE EFFECTS OF THE NEW  
ADVISORY LEVEL**

Carol Williams, Main San Gabriel Basin Watermaster

No abstract or bio submitted.

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**LEGAL PERSPECTIVE ON PERCHLORATE**

Greg Patterson

No abstract or bio submitted.